MAR 8 1990

FLOOD INSURANCE STUDY

CITY OF AURORA, OHIO
PORTAGE COUNTY

MAY 17, 1990

Federal Emergency Management Agency

COMMUNITY NUMBER - 390454

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

CITY OF AURORA,
PORTAGE COUNTY,
OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Aurora, Portage County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Buffalo District (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-87-E-2509, Project Order No. 25. This study was completed in July 1988.

1.3 Coordination

On May 7, 1987, a coordination meeting was held with representatives of FEMA, the Ohio Department of Natural Resources (ODNR), the City of Aurora, and the Study Contractor to determine the streams to be studied in detail. Also, a news article announcing the intent to perform a Flood Insurance Study for the City of Aurora was published in the Aurora Advocate. The announcement encouraged those with any relevant facts or technical data concerning local flood hazards to forward the information to the Study Contractor or the City of Aurora. Letters were also sent to the U.S. Soil Conservation Service, the U.S. Geological Survey (USGS), the Portage County Engineer, the ODNR, and the City of Aurora requesting technical data that would be useful in conducting this Flood Insurance Study.

On June 7, 1989, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Aurora, Portage County, Ohio. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of Channel Brook, Small Brook, Aurora Lake, and Tributary No. 1 was studied in detail.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Hazard Boundary Map for the City of Aurora, Ohio (Reference 1) and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through July 1993. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Aurora.

2.2 Community Description

The City of Aurora is in the northwestern most portion of Portage County in northeastern Ohio, about 15 miles southeast of the City of Cleveland. The City of Aurora is bordered by Geauga County on the north, Summit County and the Village of Reminderville on the west, Portage County and the City of Streetsboro on the south and Portage County on the east. The City of Aurora is served by State Routes 82, 43, and 306, Conrail, and the Norfolk Southern Railway. The 1980 population was reported to be 8,177 (Reference 2).

The topography of the study area is relatively flat, with wetland areas to the west and south and slightly higher land to the east. Much of the low-lying area north of Aurora Lake is highly developed as a residential area. The land surrounding the study area on the east, north, and west is hilly and rises about 40 feet above the level of Aurora Lake. That land drains to the study area, increasing the flood hazard.

The climate of Portage County is continental and characterized by marked fluctuations in temperature and precipitation. Temperatures recorded at the Akron-Canton climatological data station ranged from an extreme high of 100 degrees Fahrenheit (°F) to an extreme low of -21°F. Average yearly precipitation is 35.13 inches. The maximum recorded 24-hour rainfall is 4.18 inches (Reference 3).

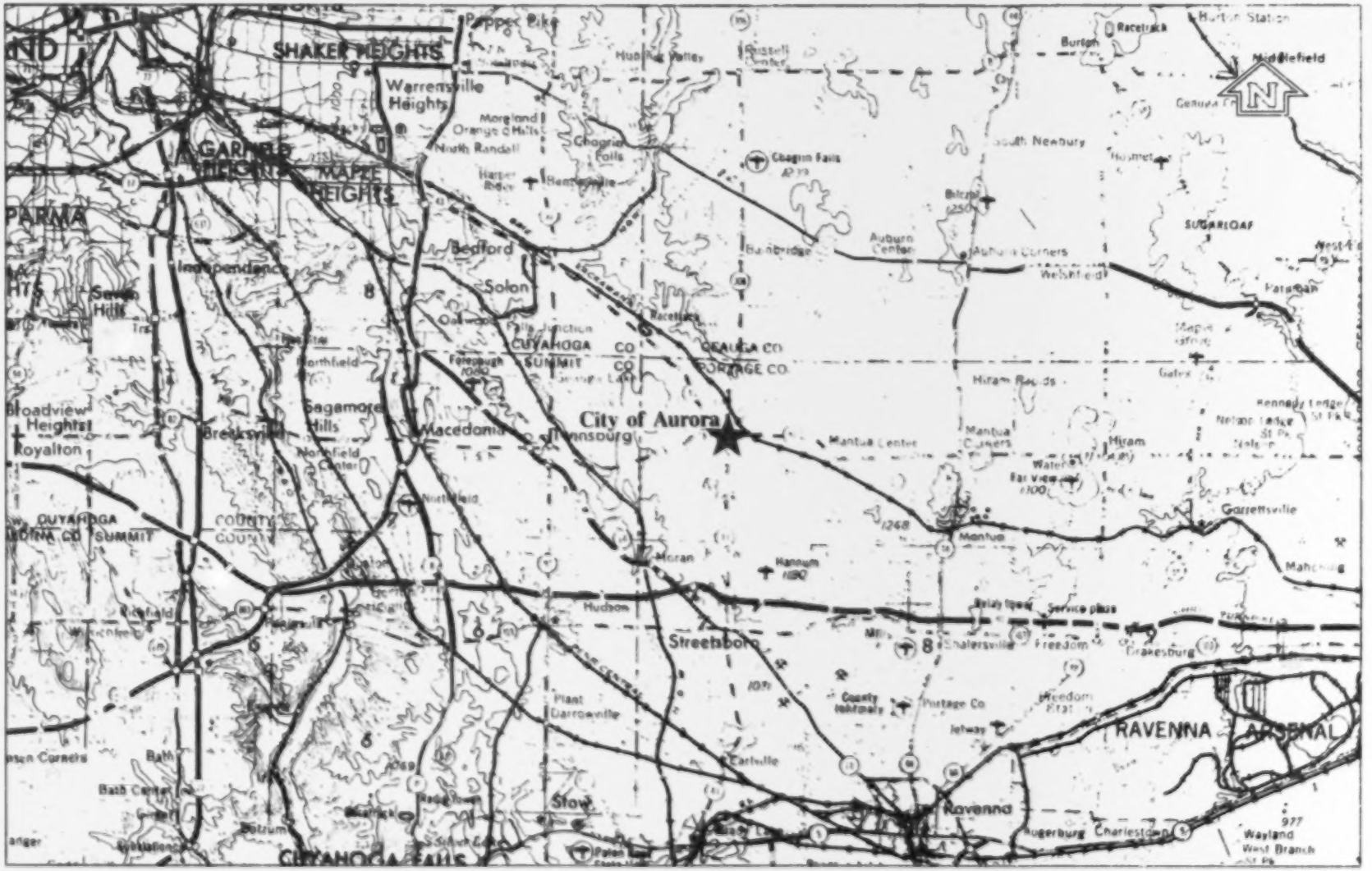


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, OH
(PORTAGE CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

2.3 Principal Flood Problems

The history of flooding in northeastern Ohio indicates that flooding may occur during any season of the year. Most of the major floods occur during the spring and are usually the result of rain and/or snowmelt. Summer cyclonic storms moving out of the southwest have also produced rainfall of high intensity and caused widespread flooding. However, past flood events are not well documented within the City of Aurora.

2.4 Flood Protection Measures

The level of Aurora Lake is controlled by a gated control structure. Past practice has been to lower Aurora Lake by about 3 feet during the fall and winter by opening the gated control structure; however, this procedure does not provide flood protection during other times of the year and does not protect the surrounding area from extreme events such as the 100-year flood.

No other flood protection measures are known to exist within the study area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40-percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60-percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

There are no USGS gaging stations in the immediate study area. The 100-year peak discharges for Channel Brook, Small Brook, and Tributary No. 1 were calculated using TR-20, a runoff hydrograph model (Reference 4).

Aurora Lake has three structures at the outlet that control the water level of the lake, two of which are uncontrolled overflow weirs. The third is a gated control structure. A combined outlet rating curve for the three outlets to Aurora Lake was established using weir, orifice, inlet control, and outlet control equations. For this analysis, it was assumed that the gate is closed and that the level of the lake is controlled by the overflow weirs. This is the normal situation during the summer, as the gated control structure is only used to lower the level of Aurora Lake during fall and winter.

Peak discharge-drainage area relationships for the 100-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 100-YEAR
SMALL BROOK		
at mouth	2.6	330
just upstream of confluence of Tributary No. 1	2.4	320
TRIBUTARY NO. 1		
at mouth	0.3	25
CHANNEL BROOK		
at mouth	2.4	215

Elevations for the 100-year floods of Aurora Lake and Channel Brook are shown in Table 2.

TABLE 2 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	PEAK ELEVATION (FEET NGVD) 100-YEAR
AURORA LAKE	
along shoreline	1,002.1
CHANNEL BROOK	
within community	1,002.1

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the backwater analysis were obtained from field surveys and topographic maps (Reference 5). All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Roughness coefficients (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observation of the streams and floodplain areas. The channel and overbank "n" values for the creeks studied range from 0.012 to 0.05 and 0.04 to 0.07, respectively.

Water-surface elevations for the 100-year flood were computed using the HEC-2 step-backwater computer program (Reference 6). The starting water-surface elevation for Small Brook was determined using normal depth at the confluence of Pond Brook and Small Brook. The water-surface elevations for Tributary No. 1 are controlled by Small Brook. The water-surface elevation for Channel Brook within the City of Aurora corporate limits is controlled by Aurora Lake.

Six 36-inch pipe culverts spaced about 550 feet apart are located along the City of Aurora corporate boundary across Small Brook. The culverts are beneath an access road to the new sewage treatment plant. Based on the results of this study, it was determined that the combined area of these culverts is sufficient to pass the 100-year flood with no significant losses or backwater effect.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 5).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Hazard Boundary Map for the City of Aurora (Reference 1).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways for this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 3, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SMALL BROOK								
A	3500	60	171	1.9	1000.2	1000.2	1001.0	0.8
B	8096	40	179	1.8	1009.4	1009.4	1010.0	0.6

[1]FEET ABOVE MOUTH

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, OH
(PORTAGE CO.)

FLOODWAY DATA

SMALL BROOK

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than 1.0-foot increase in the base flood elevations at any point within the community.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

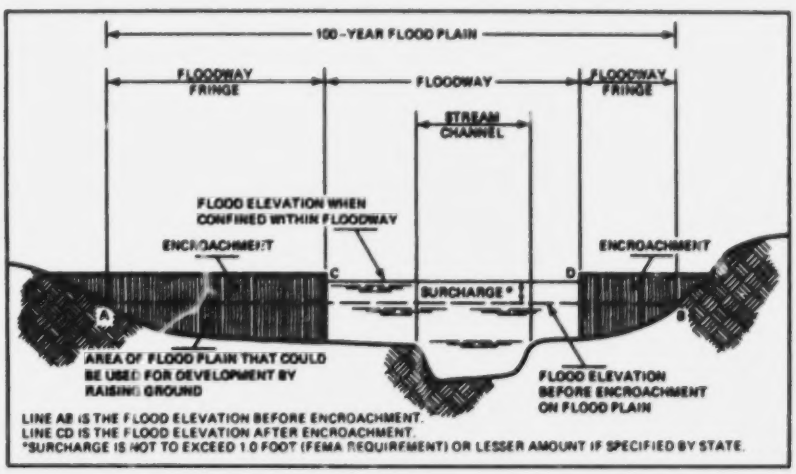

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

Flood Insurance Studies published for Geauga County, the City of Streetsboro, and Summit County (References 7-9) are in agreement with this study.

The Flood Insurance Rate Map printed for Portage County (Reference 10) is in agreement with this study.

The Flood Insurance Study in progress for the Village of Reminderville (Reference 11) is in agreement with this study.

This Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the City of Aurora (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 175 West Jackson Boulevard, 4th Floor, Chicago, Illinois 60604-2698.

9.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Aurora, Portage County, Ohio, April 1976.

2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Ohio, Washington, D.C., February 1982.

3. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Climate of the States, Climatology of the United States, No. 60 Parts 1-52, 1976-1978.

4. U.S. Department of Agriculture, Soil Conservation Service, Engineering Division, Technical Release No. 20, Computer Program for Project Formulation, Hydrology, May 1982.

5. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 Feet: Twinsburg, Ohio, 1963, photorevised 1984.

6. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, Davis, California, April 1984.

7. Federal Emergency Management Agency, Flood Insurance Study, Geauga County, Unincorporated Areas, Ohio, November 1988.

8. ————, Flood Insurance Study, City of Streetsboro, Portage County, Ohio, December 1984.

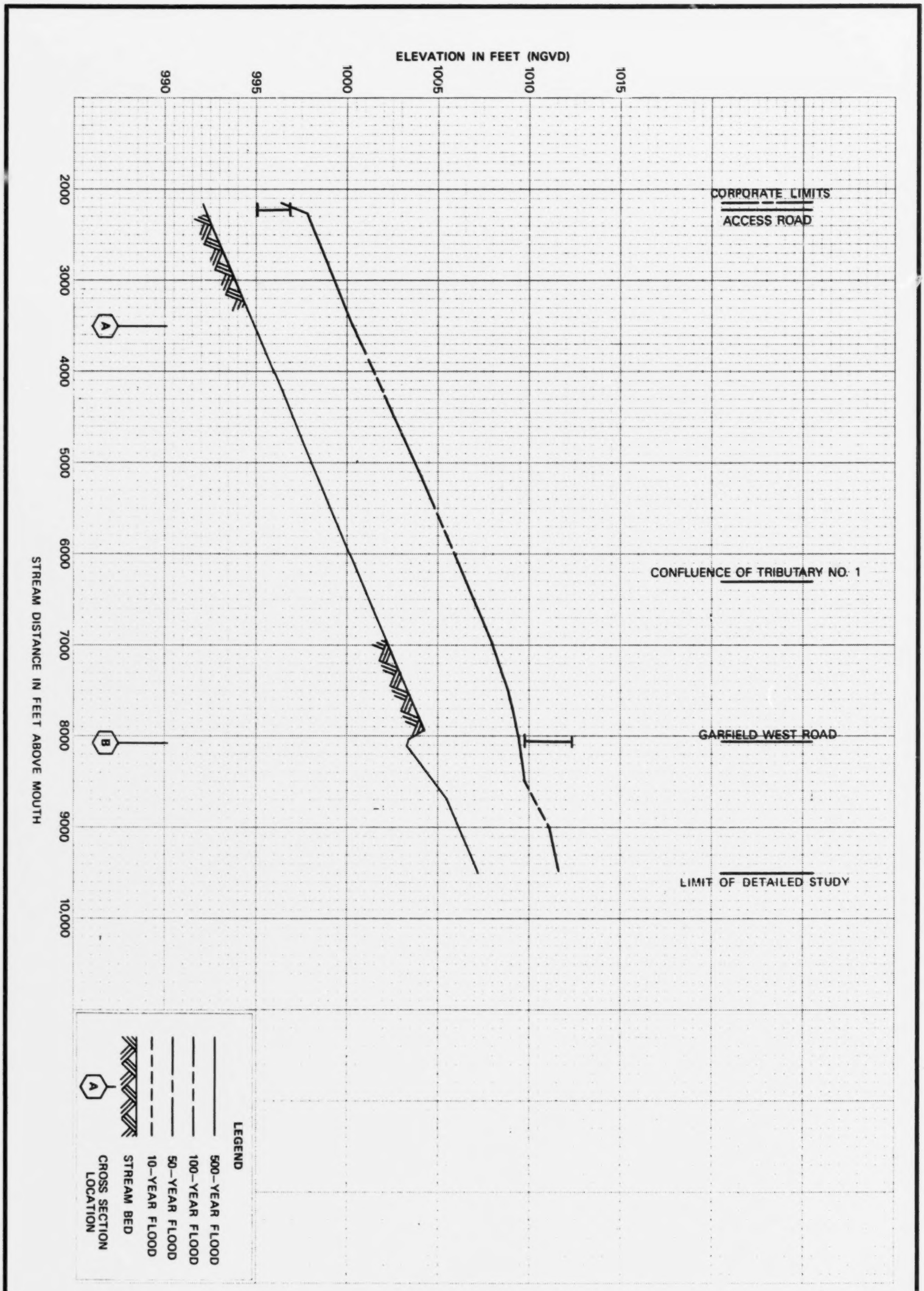
9. ————, Federal Insurance Administration, Flood Insurance Study, Summit County, Unincorporated Areas, Ohio, April 1981.

10. ————, Flood Insurance Rate Map, Portage County, Unincorporated Areas, Ohio, September 1987.

11. ————, Flood Insurance Study, Village of Reminderville, Portage County, Ohio, in progress.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0003	996.94	railroad spike in west side of 36-inch oak tree located about 1,000 feet north of Garfield West Road near county boundary, on east side of access road to new sewage treatment plant
2	0003	1,021.80	spike monument No. 95-011-1 located at intersection of Garfield West Road and Cohran Road, about 1,500 feet southwest along Garfield West Road from intersection of West Pioneer Trail Road



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01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF AURORA, OH** (PORTAGE CO.)	**FLOOD PROFILES** **SMALL BROOK**